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DISEASES DUE TO PROTOZOAN PARASITES.

DRY (F. W.). **Trypanosomiases in the Absence of Tsetses, and a Human Disease possibly carried by Simulium in Kenya Colony.**—*Bull. Entom. Research.* 1921. Nov. Vol. 12. No. 3. pp. 233–238. With 2 plates.

The first part of this paper describes investigations carried out with a view to tracing the means by which a number of cattle contracted trypanosomiasis (*T. uniforme*). The possibility of Simulium being concerned was examined, but no evidence indicative of that was obtained. Stomoxys was probably the transmitting agent.

BESSEMANS (A.). **Effect du chauffage sur les sérums de cheval dans la réaction de Bordet-Gengou pour la diagnostic de la Dourine.** [The Effect of Heat upon Horse Sera in the Bordet-Gengou Reaction for the Diagnosis of Dourine.]—*C.R. Soc. Biol.* 1921. No. 12. Vol. 85. No. 32. pp. 889–892. With 2 text figs.

The author believes that the anticomplementary power of normal sera in the presence of antigen is due in reality to a real " deviation " of a non-specific type, similar to that possessed by unheated normal human sera in the presence of colloidal antigens in the Wassermann test. This non-specific deviation can be very greatly reduced by heating the serum to 56–58° C. for half an hour. Heating to 60° C. for the same length of time practically destroys it.

MARSHALL (Claude H.). **A Paper on a New Method of Treatment of Human Trypanosomiasis.**—*Jl. Trop. Med. & Hyg.* 1921. Oct. 15. Vol. 24. No. 20. pp. 265–267.

The method described is based upon two principles :—

(1) That the disease is cured, when a cure does take place, by reason of the formation of some trypanolytic antibody in the blood.

(2) That in the majority of cases of trypanosomiasis the parasite sooner or later finds a hiding place in the cerebro-spinal canal, where

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it remains unaffected by any drugs given intravenously, subcutaneously or by the mouth, and that it is by its presence in this situation that it ultimately causes the death of the patient.

The essence of the method is that after an intravenous injection of neokharsivan (or atoxyl—in a few cases) blood is withdrawn and allowed to clot. The serum obtained is injected into the spinal canal after an equal quantity of cerebrospinal fluid has been withdrawn.

The best results have been obtained when 0·3 g. of kharsivan has been injected, 30 cc. of blood drawn after three hours, and then 15–20 cc. of clear serum injected into the spinal canal.

One injection seems to be enough.

HORNBY (H. E.) **Trypanosomes and Trypanosomiases of Cattle.**—*Jl. Comp. Path. & Therap.* 1921. Sept. Vol. 34. No. 3. pp. 211–240. With 1 text fig.

This paper is a valuable critical survey of the trypanosomiases of cattle and their causal organisms. The author considers in a few pages, which are full of evidence of the author's mastery of his subject, the various means that have been employed for the differentiation of trypanosomes and comes to the conclusion that the time is not yet for making any hard and fast statements. To quote his words, "It must remain, then, a matter of personal opinion what is the number of true species of trypanosomes occurring in cattle. We are on absolutely sure ground when we separate *Trypanosoma evansi*, *T. congolense*, *T. vivax*, *T. theileri*, and *T. ingens*. Three other trypanosomes sometimes found in cattle, the specific rank of which is recognized to-day by nearly all authorities—whatever the future may hold in store for them—are *T. gambiense*, *T. brucei*, and *T. uniforme*." Of these *T. congolense*, *T. vivax*, and *T. uniforme* are pathogenic for cattle; *T. evansi*, *T. gambiense* and *T. brucei* to a slight extent only.

The author proceeds to deal with the eight parasites given above individually. The information given is so condensed that this portion of the article does not lend itself to abstraction, and it should be consulted in the original.

An extensive list of papers consulted is given.

DELANOË (P.). **Au sujet de** *Trypanosoma talpae* **Nabarro.** [Regarding *Trypanosoma talpae* Nabarro.]—*Bull. Soc. Path. Exot.* 1921. Oct. Vol. 14. No. 8. pp. 453–455. With 1 text fig.

The author gives the measurements of three trypanosomes, the only three found in five films, stained by TRIBONDEAU's bieosinate-azur method. The average length of the three parasites measured exceeded the maximum given by LAVERAN and MARULLAZ by 8 μ.

DELANOË (P.). **Au sujet d'***Haemogregarina Brendae*, **Sambon et Seligmann.** [Regarding *Haemogregarina brendae* (Sambon & Seligmann).]—*Bull. Soc. Path. Exot.* 1921. Oct. Vol. 14. No. 8. pp. 451–453. With 1 text fig.

The author records the occurrence of this parasite in a specimen of *Psammophis sibilans*, L., captured at Bouake (Ivory Coast). WENYON's account of the parasite found by him in the same reptile occurs in the *Third Report of the Wellcome Research Laboratories*, 1908.

BRITISH MUSEUM

LIGNIÈRES (J.). **Vaccination des bovidés contre l'anaplasmose. Quelques observations sur les résultats des inoculations aux reproducteurs fins, du sang de mouton et de chèvre infecté par passages successifs.** [Vaccination of Bovines against Anaplasmosis with the Blood of Sheep and Goats infected by Passage in Series.]— *Bull. Soc. Path. Exot.* 1921. Oct. Vol. 14. No. 8. pp. 449–450.

Two years ago Lignières published the results of his investigations of anaplasmosis of bovines in the Argentine. At that time he noted that sheep and goats inoculated, although showing no symptoms, harboured the parasite in their blood for long periods. The virulence of the parasite is maintained during the first passages, but in many cases attenuation for the ox occurs, with the result that although cattle injected with these attenuated strains show no evidence of reaction, they acquire a solid immunity.

Inoculations carried out upon valuable pure-bred animals ranging from eight months to two years of age showed that a reaction occurs between the thirtieth and the fiftieth days. Such reactions may be severe. If subcutaneous and intravenous injections of 1 gm. to 2 gm. of quinine are given, the parasites are discoverable in the blood for four or five days only. A fatal result is exceptional. While encouraging results have been obtained up to the present, judgment as to the value of the method must be suspended until an interval of some years has elapsed.

FOURNEAU (E.). **Sur l'emploi de l'acide oxyaminophénylarsinique et des acides arylarsiniques en général dans le traitement des spirilloses et des trypanosomiases.** (*Note Préliminaire.*) [The Use of Oxyaminophenylarsenic Acid and Arylarsenic Acids in general in the Treatment of Spirilloses and Trypanosomiases.]— *Ann. Inst. Pasteur.* 1921. Sept. Vol. 35. No. 9. pp. 571–574.

The author points out that EHRLICH's views regarding the superior value of trivalent arsenic compounds over the pentavalent types are based upon two main conclusions: (1) That neutral salts of arsenic acid have no action upon the parasites *in vitro*, while the derivatives of arsenious acid are very active; (2) even admitting that the activity of the two types may be equal, the arsenic salts must yield in favour of the salts of arsenious acid, because none of the untoward symptoms caused by the former are observed after the administration of the latter.

Fourneau brings the following arguments against these conclusions:—

1. Results obtained *in vitro* are not necessarily those produced *in vivo*; the majority of antiseptics which are active against cultures are without effect upon infected animals.

2. Arsenious compounds are not invariably active *in vitro*. It would appear that factors other than the "arsenite function," favourable or unfavourable from the point of view of antiseptic action, come into play.

3. Arsenites are not always more active *in vivo* than the acids from which they are derived. This is the case with oxyaminophenylarsenic acid and "606."

4. It has not been shown that the nervous symptoms produced are due solely to the "arsenic acid function."

The author's original experiments carried out with German atoxyl, those recently carried out by JACOB and HEIDELBERGER at the Rockefeller Institute, and the author's own later investigations, have led him to think that the nervous phenomena referred to by EHRLICH might possibly be due to impurities in the atoxyl and to the arsenic acid used by HATA. Should this prove to be the case there would be a distinct advantage in the use of the acids in preference to the arsenites.

The author has had prepared by MADINACEITIA (Madrid) and by TRÉFOUEL and PUYAL a certain number of arsenic acids, and animal experiment has established the superiority of oxyaminophenylarsenic acid over all the others.

The sodium salt of this acid has been obtained in a state of purity, and it has been found to be extremely unstable in solution. The author has worked out the conditions for the use of this salt, which he proposes to call "189."

NAVARRO, working with the compound in MESNIL's laboratory, has proved its value in trypanosome infections, and except in cases where maximum doses were given no nervous phenomena have been observed. Solutions which have become oxidized by exposure to air, and have in consequence changed from colourless to brownish, have been proved to be obviously more toxic than the freshly prepared solutions

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DISEASES DUE TO METAZOAN PARASITES.

PATTON (W. S.). **Notes on the Myiasis-Producing Diptera of Man and Animals.**—*Bull. Entom. Research.* 1921. Nov. Vol. 12. No. 3. pp. 239–261. With 2 plates and 2 text figs.

In a concluding note to this paper the author says "medical and veterinary officers have unique opportunities of collecting these flies and of studying their habits, but I believe many are deterred from doing so because there is no easily accessible account of these interesting parasites of man and animals; I trust that these notes will in some way fill the hiatus." This valuable paper does not lend itself to abstraction, as it is very largely a detailed descriptive catalogue of the myiasis-producing diptera. An abstract could be made of the portions dealing with the technique of rearing larvae, etc., but this without the remainder would be of little value. Those interested should therefore consult the original.

MAURIAC (P.) & BOYER (R.). **Recherches expérimentales sur le traitement de la distomatose par les injections intraveineuses d'émétique.** [Experimental Investigation of the Treatment of Fluke Disease by Intravenous Injections of Tartar Emetic.]—*C.R. Soc. Biol.* 1921. Nov. 17. Vol. 85. No. 33. pp. 917–919.

Three sheep were given daily and progressive doses of a 4 per cent. solution of emetic. The first received a single series of 16 injections, the total amount given being 0·86 gm.; the second animal was given two series of injections totalling 2·16 gm., and the third three series to the total amount of 3·71 gm.

In no case was any evidence obtained that the drug acted destructively on the parasites.

RANSOM (B. H.). **Intestinal Worms in Hogs and Stomach Worms in Sheep.**—*Cornell Veterinarian.* 1920. Apr. Vol. 10. No. 2. pp. 66–74. With 5 figs.

Of a large number of pigs slaughtered at Chicago rather more than 50 per cent. of those under five months old were found to be infested with *Ascaris suum*, and of those between 18 months and four years old the percentage was 35.

The life-history of the parasite has been worked out by STEWART, FOSTER, and RANSOM recently. The embryos, which hatch out from eggs swallowed by pigs, do not develop in the intestine to the adult worm, but leave the intestine and migrate to the liver and other organs, including the lungs. Those that fail to reach the lungs undergo a certain amount of development, but degenerate and die. Those which reach the lungs can be found there within ten days of the eggs being swallowed, and there they attain a size up to 2·5 mm. (about ten times their larval length).

In the lungs they produce small haemorrhages and oedema. They may induce pneumonia, and death occurs within ten days after infection.

From the lungs the worms pass up the trachea, and down the oesophagus, and thus reach the intestine. Apparently some of the parasites make this circuit from the intestine back to it again very quickly, as it is said that they may be found there within ten days—the same period as that given for the invasion of the lungs. Those which, having reached the intestine again, are passed out with the faeces without establishing themselves soon die. For the complete development of those established in the intestine a period of about two and a half months is required, dating from the original infection with eggs.

The eggs as passed out are not infective, as exposure to air is required for the development of the embryo within the egg. Under some conditions the period required is only ten days, but usually it is much longer. The embryos having reached the infective stage of development within the eggs are very resistant to adverse conditions and may retain their vitality for years. The danger attaching to heavily infected premises is obvious.

Pigs only a few weeks old are more susceptible to infection than old animals, and medicinal treatment is useless if the lungs are heavily infested. Should they survive that phase, then anthelmintics may be given. Santonin and calomel in capsules, in doses varying from 2 gr. to 5 gr. of each, may be given mixed with sodium bicarbonate in the proportion of 2 of this to 1 of each of the other drugs. This treatment usually has to be repeated several times at intervals of a few days. Oil of chenopodium is far more effective, the rate of dosage being 1 mgm. per kilo., or 1 dram per 100 lb, and it should be given only in conjunction with castor oil. Of the latter 1 oz. to 2 oz. should be given. It is dangerous to give oil of chenopodium without the castor oil. The treatment should be repeated after a week or ten days.

Haemonchus contortus. Our knowledge of the life-history of this parasite is due mainly to Ransom (1905) and VEGLIA (1915). The eggs, which are passed out, hatch in about 24 hours at summer temperature. Below 40° F. the eggs lie dormant or die, but some occasionally survive freezing temperatures.

The first 24 hours after hatching are taken up by two equal periods, one of activity and one of rest. Then follows a moult. After this

the larva is active for about 36 hours and then quiescent for 8 to to 12. The larva is now in the infective stage, and although it has acquired a new cuticle, the old one is not shed. At this stage of development the larvae are very resistant to adverse conditions and may survive a winter.

When such larvae are ingested they moult, and after about 36 hours become quiescent for a time and again cast their skins and begin to grow rapidly. They attach themselves to the mucous membrane, and by the fifth day the sexes are distinguishable. After a further moult, about 15 days after infection, copulation occurs. The adults live for many months in the stomach, and it was proved experimentally that removal from infected pasture alone was not sufficient to ensure eventual freedom from the parasites. Although the numbers in the stomachs diminish, they may still be found as long as 18 months after the animals have been removed from all possible sources of infection.

Control measures involve the avoidance of low-lying ground, of the use of permanent pastures as far as possible, and of overcrowding. Frequent changes of pasture assist in minimizing the infestation. It requires a period of about a year to clear a pasture after sheep and cattle have been removed.

It was found experimentally that removal of lambs to fresh grazing grounds every three weeks between May and November, and the dosing of all ewes once a month with sulphate of copper until the lambs were weaned, proved very efficacious in controlling the disease, provided ewes and lambs were kept separate after the latter were weaned.

When frequent changes of pasture cannot be given ewes and lambs should be dosed with copper sulphate once every four to six weeks from May till October. A 1 per cent. solution is used, and the doses are $1\frac{3}{4}$ oz. for lambs under one year and $3\frac{1}{2}$ oz. for sheep over one year. The best results are obtained if the doses are given to the animals after fasting overnight, and no water should be given for two hours after the administration.

JACK (R. W.). **Ticks infesting Domestic Animals in Southern Rhodesia.**—*Rhodesia Agric. Jl.* 1921. Aug. Vol. 18. No. 4. pp. 361–371. With 1 plate. (To be continued.)

The object of these articles is to place in the hands of those interested, in handy form, a guide to the ticks infesting domesticated animals, descriptions of their habits, life-histories, the relations they bear to disease, and measures employed for their control.

Ticks are divided into two main families, the most obvious distinguishing feature being the presence, in the case of the Ixodidae, of a hard shell on the back of the tick, and its absence in the Argasidae. This shell covers the entire male, but in the female a small area only close behind the head. In the Argasidae also the mouth parts are invisible from above except in the larval stage.

In all the Ixodidae the life cycle is the same. The six-legged larva hatches from the egg, and on moulting becomes an eight-legged nymph. This nymph moults, and sexually differentiated adults result. The ticks are blood-sucking parasites in all their stages, but the habits of all species are not the same. Some drop off the host and moult on the ground, others remain attached to a single host throughout their cycle. They may be conveniently described as having one, two or three-host cycles.

Hyalomma aegyptium impressum. The bont-leg tick. [The word bont means particoloured.]—These ticks have dark brown bodies and particoloured legs. The tick has either a two or three-host cycle, but generally two-host. This appears to be the only tick in which individual variation of the life habits has been observed. The larvae and (in the two-host cycle) the nymphs of this species are not known to attach themselves to cattle, but feed upon rabbits, hares, etc. The adult ticks are common on cattle, but are not known to transmit any specific disease.

In Africa the hosts of the adults are ox, buffalo, dromedary, rhinoceros, horse, ass, giraffe, sheep, goat, pig, dog, man, poultry and ostriches. Larvae and nymphs have been recorded on hares, rabbits, fowls, ostriches and other birds.

Amblyomma hebraeum. The bont tick.—The shield of the male tick shows brown-black markings, the spaces between being green to yellow. The legs are particoloured. In the female the markings are more variable. The remainder of the back is dark brown.

This tick has a three-host cycle. Eggs require six months or more for hatching in the winter and about two and a half months in the summer.

The larva engorges in about a week, and requires one to three months to moult. The nymph requires about the same length of time for engorgement, and the second moult requires from a fortnight to one and a half months. Females require about a week to engorge. The males remain attached for long periods.

This tick transmits heart-water of the sheep, goat and calf in the South African Union. The tick is not known to occur in Rhodesia.

The adult bont tick has been recorded from cattle, sheep, goats, swine, horses, rhinoceros, giraffe, antelope, buffalo, lion, wild dog, etc.

Amblyomma variegatum. The variegated bont tick.—The male of this species is distinguished from that of the preceding, in spite of the general similarity in the type of the markings on the shield, by the following points: the edges of the shield are dark instead of pale, the light markings are coppery red instead of green. The markings on the shield of the female are variable, and it is sometimes dark without any light patches. The life-history resembles that of the bont tick. Transmits heart-water. Very liable to cause abscesses and sloughing of the skin. This appears to depend to some extent upon the length of the mouth parts

Amblyomma marmoreum. The tortoise tick.—Not commonly found on warm-blooded animals, but a frequent parasite of reptiles.

Rhipicephalus appendiculatus. The brown tick.—There are many species of this genus, but they bear very close resemblance to each other. Males and females are both uniformly brown when unfed. The engorged female has a slaty-blue colour.

Has a three-host cycle. Larva feeds three days or more. Moult lasts a fortnight or longer. The nymph feeds for four to six days. It is estimated that two complete cycles may be passed in a year.

Transmits East Coast fever. The infection does not pass through the egg. May become infected as larva or nymph and pass on the infection at the next stage. An infected larva feeding on a non-susceptible animal is thereby cleaned and is not infective as a nymph.

Transmits redwater as an adult which fed as a nymph on an infected animal or as a larva derived from a female which fed upon an infected animal—*i.e.*, in this case the infection does pass through the egg.

Transmits gall sickness (*Gonderia mutans*).

Rhipicephalus evertsi. The red-legged tick.—Adults attach themselves for preference under the tail, the nymphs in the ears.

Has a two-host cycle, the larva-nymph moult taking place on one host.

Can transmit gall sickness and biliary fever of horses. In both cases the diseases are transmitted by adults which have fed upon infected animals in the larval and nymph stages (single host).

The parasites of redwater and spirochaetosis (affecting cattle, sheep and horses) are transmitted through the egg.

Rhipicephalus simus. The black-pitted tick.—Has a three-host cycle, and can transmit anaplasmosis.

Rhipicephalus sanguineus. The European brown tick.—Is not limited to Europe, but occurs in Africa and India. In the latter country it transmits canine piroplasmosis (malignant jaundice). This disease may be transmitted in three ways: The progeny of an infected female may be infective as (1) nymphs, (2) adults. Nymphs fed upon an infected animal may become infective as adults (3).

Margaropus decoloratus. The blue tick.—Distinguishable by the pale-coloured legs. The fed female has a greenish blue colour, distinguishing it from the engorged female of *R. appendiculatus*, which is slaty-blue. The tick has a single-host cycle, and the warmth of the body influences the rate at which the life cycle is passed through. Several generations may be passed through in a year.

Where dipping is not practised this is probably the commonest tick, but owing to its single-host habit it disappears most rapidly when dipping is carried out.

Transmits redwater and anaplasmosis, and also spirochaetosis of cattle, horses and sheep. The infection passes through the egg and is transmitted by the larva.

Margaropus witherni. Horse tick.—Is a South American tick which was probably imported into South Africa during the Boer War. The male has very thick legs, the individual elements of each somewhat resembling a rounded bead. The female somewhat resembles that of the blue tick, but is larger, and the outer end of each article in the legs has a dark marking on it.

Haemaphysalis leachi.—This is probably the commonest tick of the dog in Rhodesia. The male tick is uniformly brown and the engorged female very closely resembles the brown tick in the same condition, that is, it is a slaty-blue colour. The head is shorter and broader than that of the brown tick. In the male tick there is a deep uniform groove close to the edge all round the shield except in front.

The tick has a three-host cycle, and probably completes two cycles in the course of a year.

Transmits malignant jaundice, and the manner of transmission is peculiar in that the infection passes through the egg, but the progeny are not infective until the adult stage is reached.

The tick is found mainly on carnivora.

ROUBAUD (E.) & DESCAZEAUX (J.). **Contribution à l'Histoire de la Mouche Domestique comme agent vecteur des Habronémoses d'Equidés. Cycle évolutif et parasitisme de l'*Habronema megastoma* (Rudolphi, 1819) chez la mouche.**—*Bull. Soc. Path. Exot.* 1921. Oct. Vol. 14. No. 8. pp. 471–506. With 1 plate and 9 text figs.

The equidae are hosts of three Habronema (or Spiroptera): *H. muscae* and *H. microstoma*, which live free in the stomach, and *H. megastoma*, which is to be found in tumour-like growths near the pylorus of that organ.

Apart from these, however, investigation has shown a not inconsiderable number of apparently "erratic" localizations, such as dermatitis, granular conjunctivitis, summer sores, etc. The parasite named *Dermofilaria irritans* by RIVOLTA in 1868 has been shown by many investigators to be a larval Habronema. Other investigators have established the occurrence of a pulmonary habronemosis of horses, also caused by larvae, in this instance of *H. megastoma*.

After summarizing recent work regarding the development of the parasites in the flies and the methods of transmission, the authors proceed to a description of their own experimental work.

Flies ready to lay eggs were caged in wide-mouthed bottles covered with muslin with sterilized horse faeces. When the eggs were laid they were transferred to similar jars also containing sterile faeces.

Stomach lesions due to *H. megastoma* were carefully opened and the contents mixed with tepid distilled water. This was then mixed with the faeces in the wide-mouthed bottles. Larvae and pupae were examined daily. The process of pupation required about a week before it was complete. The pupae were then taken from the moist medium and placed in dry bottles, which were covered with two layers of gauze.

From two to three days later a dozen flies hatched out in two of the bottles. None of those placed in the third jar hatched at all, and the failure to do so was proved to be due to intense infestation with parasites. Many of the pupae in the other jars failed to hatch for the same reason.

The flies in the first jar which had contained larvae four days old contained from 25 to 30 parasites each. Those in jar No. 2, which had contained larvae just hatched, contained from 75 to 150 parasites. It would therefore appear that infestation occurs with greater ease when the larvae are young.

The eggs of Habronema are oval in shape and measure from 40 to 50μ by 9 to 11μ, and they contain an embryo which entirely fills them. The first penetration of the parasite into the fly is certainly passive, and takes place by ingestion. Embryos were found in the digestive canals of larvae two days after sowing out. They were very actively motile, and in some cases had not fully escaped from the egg. These embryos measured from 105 to 110μ in length by 7 to 10μ in thickness. The anterior end is furnished with a stilette with a V-shaped basal armature, but without a sheath. This shows very rapid retractile movements. The body substance is uniformly granular. Curved embryos may be found similar to those observed in the faeces.

The subsequent stages of development occur exclusively during the larval and nymphal stages, in the Malpighian tubes.

The larvae appear to invade these about the third day. Here the motility of the embryo is less marked and the body appears to be

shorter and slightly thicker. The posterior end becomes more blunt and shows a clear vesicle.

By the fourth day the stilette has disappeared, and the parasite gradually becomes sausage-like. At the anterior end indications of the pharynx make their appearance, at the hinder end the caudal vesicle is clear and traces of the pyriform rectum make their appearance. Throughout the length of the body nuclei are scattered without apparent order.

At the onset of the nymph stage the parasites are sausage-like again. They are feebly motile, and frequently curved. They range from 200 to 500μ in length by 30 to 35μ in thickness. As the worms grow the differentiation of the organs becomes more distinct, and about 50μ from the anterior end a ring of large nuclei marks the nerve ring.

On the sixth day the epithelial cells of the Malpighian tubes of the nymph enclose the larvae-like cysts, within which the parasites are coiled on themselves. By this time they have entirely lost the sausage shape and are from 600 to 900μ by 50 to 60μ. The oesophagus, intestine, pyriform rectum and nerve ring are clearly discernible. The intestine is about twice the length of the oesophagus. The anus is closed and prominent at a point some 70μ from the posterior end. The mouth and pharynx are very distinct.

By the following day the parasites are nearly twice the size and are surrounded closely by a thin membrane, which represents all that remains of the Malpighian cell. This membrane envelopes the parasite so closely that it appears as if the parasite were moulting. By now the rectum has become elongated and narrow and has taken up a position in direct line with the intestine. The cuticle of the caudal expansion shows beneath it the little spines which are characteristic of Habronema in the definitive stage.

In flies which have just emerged from the pupae the same forms of the parasite are found as in the pupal stage, and these are still enclosed in the remains of the Malpighian epithelium, but they show a gradually increasing degree of active movement. At about the same time free larvae are found in the body cavity. These, as a result of moulting, have acquired all the characters of the mature larvae, including the spines on the caudal expansion.

During the ninth to eleventh days the number of free larvae increases, and in dead flies they literally swarm. The head and thorax are filled with them, as is also the proboscis, which is actually made to move by their activity.

At this final stage of development in the intermediate host the parasites have the following characters: length, 2·7 mm. to 3 mm.; width, 60μ to 85μ. The anterior end shows a constriction which marks off the cephalic portion. The mouth shows a large anterior and posterior lip and two small lateral ones. The oesophagus is of the usual shape and occupies about one-third of the body length. The anus opens about 100μ from the posterior end and has a valve-like shape.

The facts observed by the authors indicate that the embryo worms reach the Malpighian tubes by boring their way out of the intestine into the body cavity and thence into the Malpighian tubes from the outside. There are three distinct phases of development of the larvae, separated by moults. While the cycle of development in the fly shows close analogies with the cycles of other members of the Spiruridae and Acuariidae, it differs markedly from these in that there is no

encapsulation of the second or sausage-like phase. While the larvae of Habronema become free during the third stage preparatory to passing to the definitive host, the other Spiruridae remain encapsuled and pass into the definitive host in that condition. It was found that faeces retained their infective power for about 12 days at the temperature at which the experiment was carried out (23° C.). Higher temperatures, such as are generated in manure heaps, have a more destructive effect.

None of the infested flies lived more than seven days, and many died the day after hatching, owing to the destruction of the Malpighian epithelium.

The mechanism by which the larvae make their escape from the proboscis is given in detail, and the evidence appears to show that the temperature of the horse, which represents the definitive host of the larva, plays some part in the liberation, as it has been found impossible to get larvae from infected flies by feeding them on any media such as sugar, blood, pus, etc.

Horses probably acquire the parasite through infected flies feeding upon wounds or exposed mucous membranes. Infection through ingestion of dead contaminated flies is probably merely accidental, and one is compelled to think that the larvae reach their predilection seats by their own efforts. It has been proved experimentally that the larvae, if they are to remain alive and carry on their life cycle, must be deposited upon a moist surface. Five minutes on a dry slide proves fatal to them.

In moist media, *e.g.*, tap water, serum, broth, etc., larvae never survived more than 48 hours at ordinary temperatures. At body temperature the duration of life is about the same. They may maintain their vitality for the same length of time in dead flies so long as the tissues of the fly do not become dried up. Thus food and water may become contaminated with embryos from dead flies. No proof has been forthcoming for the hypothesis that the embryos are able to penetrate sound skin, and they do not appear to be able to penetrate the skin when the epidermis alone is damaged. Contrary to the findings of Van Saceghem and in agreement with that of Bull, the cause of summer sores in France is probably *H. megastoma* (supported by one experiment). So far no proof has been furnished of the hypothesis that the larvae found in summer sores can reach the stomach. These larvae appear to be "erratic" and incapable of further development.

The same appears to be the case with the larvae which are responsible for pulmonary habronemosis in France. Those parasites are invariably found in the lumen of the bronchioles. The peribronchitis is a sequel. Those larvae which penetrate into the bronchioles do not appear to live for more than about a week.

The case of *H. microstoma* is possibly different from that of the other two species, since it undergoes development in a biting fly—stomoxys. This fly does not attack the lips and nostrils, but the legs, and the larvae can therefore only reach the lips by indirect methods, such as gnawing.

As might be expected, there is a close relationship between the life cycle of the parasite and the life-history of the fly. During June and July the stomach tumours contain large numbers of eggs containing embryos of Habronema and gravid females. The eggs are therefore expelled when flies are numerous. During August the

" tumours " are empty, but larvae identical with those occurring in the flies begin to make their appearance. No mature worms are to be found in the tumours during September, at least the eggs from such gravid females as may be found are not viable. Hot weather therefore appears to be necessary for development. During the winter the growing larvae may be found in the tumours. They mature and the liberation of eggs begins again at the beginning of the following summer.

SEWELL (E.). **A Note on the Importance of the Genus** *Habronema* **as an Economic Factor amongst the Equidae of the Punjab and the North-West Frontier Provinces.**— *Vet. Jl.* 1921. Oct. Vol. 77. No. 10. pp. 381–383.

The author has had the opportunity of making post-mortem examinations of a large number of horses and mules destroyed on account of debility, and in every instance has traced it to the presence of one or more species of Habronema.

Habronema megastoma is responsible for tumour-like growths of various sizes in the neighbourhood of the pylorus, and *H. muscae* and *H. microstoma* may be detected on the mucous membrane of the cardiac portion of the stomach.

An outline description of the life-history of the parasites is given.

The eggs, which are passed out with the faeces, are ingested by the fly maggot, and the embryos eventually reach the thorax and proboscis of the mature fly, and it is supposed that the horse infects himself by ingesting infected flies.

H. muscae and *H. megastoma* have their host in the common housefly, and *H. microstoma* in *Stomoxys irritans*. The fly can only become infected as a larva.

Bursati is probably due to the larvae of the Habronema.

Preventive measures are concerned very largely with the proper treatment of manure with a view to the destruction of the larvae.

Oil of chenopodium is valuable against *H. muscae* and *H. microstoma*, and may possibly be of some service against *H. megastoma*. The possible value of carbon bisulphide is suggested.

VAN SACEGHEM regards the following local application as a specific cure for summer sores :—

Plaster of Paris	100
Alum	20·
Naphthalene	10·
Quinine	10·

To be applied after thorough cleansing and disinfection of the sore. The dressing dries the sore rapidly and prevents the attacks of flies.

BISHOPP (F. C.). *Solenopotes capillatus*, **a Sucking Louse of Cattle not heretofore known in the United States.**— *Jl. Agric. Research.* 1921. Sept. 1. Vol. 21. No. 11. pp. 797–801. With 6 text figs.

In this paper the author establishes the observation made by ENDERLEIN in 1904 of the new genus and species of sucking louse named in the title of the paper. The validity of the nomenclature was questioned by FERRIS in 1916. .

ENDERLEIN's original description was based upon the examination of a single male. In the paper here abstracted detailed descriptions of the male, female, nymphal stages and egg are given.

YORKE (Warrington) & SOUTHWELL (T.). **Lappeted *Anoplocephala* in Horses.**—*Ann. Trop. Med. & Parasit.* 1921. Sept. 30. Vol. 15. No. 3. pp. 249–264. With 11 text figs. and 1 plate.

In this paper the authors give descriptions of two Anoplocephala: the first found in zebra in North-eastern Rhodesia, and the second in horses in England and elsewhere. Neither is a new discovery. The parasites found in the zebra are identified with *Taenia zebrae*, Collin, 1891. The object of the re-description of the parasite found in the horse is to draw attention to the variations which may occur.

The following technique was employed in the examinations: the parasites were stained entire for several days in acetic-acid-alum carmine, and washed, and taken through alcohols to clove oil. When clear, segments were detached singly and mounted serially with the anterior surface upwards. The microtome was resorted to for the anterior portions as it was found impossible to manipulate the minute segments. Horizontal sections were also examined.

I. Anoplocephala rhodesiensis.

	Long.	*Broad.*	*Thick.*
Largest specimen	114 mm.	22 mm.	3·25 mm.
Smallest specimen	14 ,,	4·25 ,,	1·75 ,,
Average size ..	90 ,,	20 ,,	3 ,,

Specimens under 30 mm. were immature. In an average specimen there were about 250 segments.

Head.—Cuboid, about 2 mm. long by 3·25 mm. broad. Suckers placed facing directly forwards and separated by grooves.

The lappets are about 1·25 mm. long by 1·75 mm. broad, and in some specimens they were globular and filled with fluid.

The general shape of the worm varies with individuals, but generally the greatest breadth is about 1 cm. from the posterior end.

The segments are very shallow and imbricated.

Internal anatomy.—Longitudinal and tranverse muscles are strongly developed; dorso-ventral muscle is less marked.

There are three longitudinal nerves on either side, the median being by far the larger.

The water vascular system is well developed and comprises a large ventral vessel and a smaller dorsal one.

At least the whole of the posterior half of the worm is sterile and shows no traces of genitalia. As no evidence could be found that segments had been shed it appears to be probable that the worm is passed entire with the faeces.

Testes are found in the fifth to twenty-fifth segments. At their maximum they measure 50 to 90μ by 30 to 70μ, and they usually lie three or four deep in the dorso-ventral direction in the medullary parenchyma.

The vas deferens after running laterally from the testes for a short distance, dilates into the outer seminal vesicle. It then narrows, and enters the cirrus pouch, where it again dilates to form the inner seminal vesicle. The cirrus is long, slightly coiled, and armed with very minute spines.

The ovary first appears at about the last segment shewing testes, and is present in about ten segments. The ovary consists of a series of vertical club-shaped columns arranged two deep antero-posteriorly and measuring 170μ by 60μ.

The vagina is well developed by the sixteenth segment. From the pore, after travelling a short distance ventrally, it becomes dorsally

placed and enters the large receptaculum seminis. This is roughly club-shaped with the dilated inner end bent ventrally. The genital pores are all dextral.

The vitelline glands appear at segment 7, and disappear at segment 40. They lie close to the inner end of the receptaculum seminis. The shell gland appears to lie dorsal to it. The uterus, of which the first evidence is seen about the fifteenth segment, is fully developed in the second forty segments, and contains ova. At this point it is a straight wide tube devoid of outgrowths.

Eggs.—Although sixty worms were examined no mature eggs were found. Large and small eggs were often found in the same uterus. The large, which measured about 25μ, appeared to have three envelopes, the embryo occupying the innermost completely and measuring about 11μ. The bulk of the eggs did not exceed 15μ.

All attempts to discover a pyriform body failed.

II. Anoplocephala perfoliata (Goeze, 1782). Blanchard, 1848.

This species measures 30 mm. to 45 mm. in length by about 12 mm. in breadth.

The head is almost cubical. The suckers and lappets and muscular system resemble those of *A. rhodesiensis.*

Segments number 90 to 130.

As a rule three longitudinal nerves were present on each side, in some cases the median nerve was the only one constantly present. Different segments of the same worm showed the dorsal and ventral nerves present or absent. Excretory system as in *A. rhodesiensis* but smaller.

The segments become increasingly ripe towards the posterior extremity, and only an occasional sterile segment was found here and there.

There appeared to be no doubt that segments had been shed from the posterior end. The testes appear about segment 12 and disappear at about the thirtieth.

It would appear that the testes vary markedly in the stage of development in different individuals, or individuals from different hosts. In old worms they seem to degenerate and disappear.

The outer and inner seminal vesicle did not exhibit any constant relationship to each other. The ovary is present in segments 25 to 45. In some specimens examined the ovaries had entirely disappeared.

The uterus makes its appearance as a delicate cell string about the twelfth segment, and it attains its full development only in the last few segments; there it shews numerous anterior and posterior pocketings.

Fully mature eggs were found in the last few segments only. The outer envelope was about 80μ in diameter and the embryo about 16μ. The length of the horns of the pyriform apparatus was about 18μ. As the egg matures its envelope shrinks, and its measurements are therefore valueless. In quite ripe eggs the horns of the pyriform apparatus are prolonged into very long slender filaments which eventually unite with one another.

The authors conclude that the points held by FÜHRMANN to distinguish *A. zebrae* (Führmann) from *A. perfoliata* have no specific value. In their experience the only constant points of difference between the Anoplocephala of the zebra and horse are :—

1. *A. rhodesiensis* is the more massive and has twice as many segments as *A. perfoliata.*

2. The posterior half of *A. rhodesiensis* is entirely sterile, whereas *A. perfoliata* is ripe up to its posterior extremity.

BACTERIAL DISEASES.

FLEISCHNER (E. C.), VECKI (M.), SHAW (E. B.) & MEYER (K. F.). **The Pathogenicity of *B. abortus* and *B. melitensis* for Monkeys. Studies on the Genus Brucella Nov. Gen. III.**—*Jl. Infect. Dis.* 1921. Dec. Vol 29. No. 6. pp. 663–698. With 4 charts.

In this paper are recorded a number of experiments which were designed to throw light upon certain aspects of the relationship between *B. abortus* and *B. melitensis*.

The results obtained are best given in the authors' own words.

"Following an intravenous inoculation of *B. abortus*, agglutinins develop fairly rapidly in the blood of monkeys. The animals may show an intermittent type of fever and lose weight. At post-mortem examination it is possible to recover the organisms from the spleen, lymph nodes, and liver, while even on the fourth day after the injection the blood-stream is found sterile.

"By feeding the growth of glycerol agar cultures of moderately virulent strains of *B. abortus* on carrots, bread, or apples in large and repeated doses, it is possible to obtain definite infections in a fairly large percentage of monkeys. The duration of incubation, as judged by the appearance of serum agglutinins, is always prolonged, and at least 30 to 40 days may elapse until such substances can be demonstrated. The infection can be positively proven by the isolation of *B. abortus* from the spleen, and occasionally from other tissues.

"The repeated oral administration of massive doses of highly virulent *B. abortus* cultures causes a rapid development of specific agglutinins; by the sixteenth day the serum may be active in a dilution of 1 : 40–80. Interruption of the feeding leads to a gradual diminution of the antibodies, probably on account of the disappearance of the bacteria from the tissues. Milk of cows heavily contaminated with cultures of *B. abortus* of low virulence when fed for at least 52 days, failed to cause infections. The mere ingestion of cow's milk rich in agglutinins never led to an appearance of these substances in the serum of monkeys.

"Milk obtained from goats which had been experimentally infected with *B. abortus* of low virulence and which contained relatively few bacteria, failed to produce an infection in monkeys, even when fed for 12 to 42 days.

"By feeding repeatedly the milk of a goat that had been infected by the injection into the udder of a very virulent strain of *B. abortus* of porcine origin, it was possible to infect one monkey. *B. abortus* was isolated at necropsy from all the viscera and the heart blood.

"Serum agglutinins specific for the bacteria of the Brucella group are formed only in the presence of a definite infection. The ingestion of heat-killed, autolysed abortion bacilli is antigenically ineffective in monkeys.

"Certain strains of *B. melitensis*, which produce characteristic lesions in guinea-pigs resembling those of *B. abortus*, when injected into monkeys intravenously give rise to characteristic temperature, positive agglutination reactions, and the organisms are recoverable at the post-mortem examination from various tissues.

"One atypical *melitensis* strain, introduced via the alimentary canal, was not always pyrogenic, but it stimulated agglutinins, and the ingested bacteria persisted for at least 57 days in the spleen and mesenteric lymph nodes.

"The microscopic changes produced by a *B. melitensis* or by a severe *B. abortus* infection in the monkey resemble those of an early typhoid infection."

Summary.—"Virulent strains of *B. abortus* in sufficiently large dosage are pathogenic for monkeys.

"*B. melitensis* is far more invasive than *B. abortus*. One or two feedings of one-thousandth the amount necessary to cause an infection with *B. abortus* is sufficient in *melitensis* infection to parasitize a monkey."

RECORDS (E.) & VAWTER (L. R.). **Ictero-hemoglobinuria in Cattle.**—*Jl. Am. Vet. Med. Ass.* 1921. Nov. Vol. 60. No. 2. pp. 155-164.

This name has been proposed by the authors for a disease more commonly known as "red-water disease" in the districts where it occurs. It is widely prevalent on the Pacific Coast and in neighbouring states.

As a rule the disease does not occur as a widespread outbreak, but an occasional animal dies throughout the season.

The typical symptoms are: Sudden suspension of the normal functions and loss of appetite, arching of the back, coat dry and harsh; distressed expression, and eyes appear sunken; accelerated, shallow respiration, with an expiratory grunt; icteric membranes. As a rule the temperature at the onset is about 106°, but this drops later, and may be subnormal for some time before death.

As the disease progresses the bowels become very active, and small movements are passed which may be almost entirely composed of blood. Urination is frequent and copious, and the urine is of a deep garnet colour. The red-cell count drops to about two million and the leucocyte count rises to about 40,000. The period of illness averages about 36 hours.

Rigor mortis develops rapidly after death; the lesions associated with anaemia and jaundice are found. Petechial haemorrhages are found in the subcutis, and in some cases there is haemorrhagic oedema along the neck and shoulders. The abdomen may contain as much as two litres of blood-tinged transudate; the serous membranes show petechiae and haemorrhages. The mucous membrane of the duodenum shows desquamation and haemorrhages.

Elsewhere in the intestine the mucous membrane may show deep erosions. There is invariably thrombosis of the portal vein, with resulting infarction. The spleen is not enlarged, but its surface shows ecchymosis. The kidneys show punctate haemorrhages in the cortex.

The lesions in the thorax are parallel with those in the abdomen.

Bacteriological investigations have yielded the following results:—

Bacillus botulinus has been recovered from the liver infarcts in four cases, but not in a state of purity.

B. oedematiens and *B. histolyticus*, both mixed with other anaerobes, have been recovered from the same place in other cases. A Gram-positive diplococcus, apparently belonging to Type IV pneumococcus group, has been found in every case.

B. sporogenes has been recovered from most of the cases.

B. welchii, Type IV, has been found in every case when the methods employed have been suitable for its detection. It has been recovered from the liver infarct, portal, mesenteric and mediastinal lymph glands, spleen, and heart muscle, but it has never been recovered from the blood, but it is the only organism recovered which has possessed haemolytic properties.

It is noted that bacteriological investigations were carried out only when the animal had been dead less than four hours. Many of the organisms recovered were tested by inoculation on small animals and upon cattle, but the organism mainly concentrated upon was *B. welchii*.

Enormous doses of culture administered orally were practically without effect. Of about 30 head of young cattle inoculated intramuscularly into the thigh with 25 to 35 mil doses, all developed local oedema, and two showed marked haemoglobinuria, jaundice, and other manifestations resembling those seen in a natural case, including a marked drop in the red-cell count (to about 3,000,000).

The post-mortem lesions, while not reproducing exactly those of a natural case, approximated very closely to them. The liver infarcts were small and multiple, and the authors consider that this may be due to the difference in the method of infection.

None of the other organisms recovered proved to be pathogenic for bovines. WOOD, working in California, has had parallel results.

The fact that *B. welchii* is not found in a state of purity does not exclude it from being the possible cause of the disease. It appears to be probable that some predisposing factors make it possible for this bacillus to assume invasive properties, and to establish itself in apparently normal animals. Some of the apparently predisposing conditions are :—The disease is, as a rule, seen during the summer, but occasionally cases are observed during the winter. Most cases occur on land into which water drains and cannot escape. Maximum stagnation and concentration of the pools in such areas seem to be associated with the greatest incidence of the disease. It is exceptional to find cases out of irrigation areas on the open ranges, but they do occur when the animals are receiving hay and well water, and, as a rule, this hay comes from the type of land upon which cases of the disease occur.

An aggressin, prepared by inoculating young cattle with *B. welchii*, has been used on about 1,200 animals in most seriously affected districts. No figures are available, but the percentage of cases is said to be lower among the animals treated with the aggressin than among the untreated controls. This method of protection, if proved to be valuable, could not be practised on a large scale, owing to the small percentage of successful inoculations of cattle with *B. welchii*, this rendering the cost prohibitive.

However, as the authors point out, this question hardly arises until the etiology of the disease has been established definitely.

HADLEY (F. B.). **Results from immunizing Cattle against Abortion.**—*Jl. Am. Vet. Med. Ass.* 1921. Oct. Vol. 60 (New Series 13). No. 1. pp. 26–33.

The results obtained with 474 cows and heifers which were vaccinated and 101 controls are given in this paper. Among the controls roughly 30 per cent. aborted, while among the vaccinated animals the figure was about half that. It is to be noted, however, that 44 of the animals vaccinated were pregnant at the time of the operation. Of these 13 had not and 31 had previously aborted. The percentage of normal calvings in the latter of these groups was practically the same as the percentage obtained when cows which had previously aborted were vaccinated before being put to the bull again.

Vaccination of non-pregnant cows which had not aborted yielded a distinctly higher percentage of normal calvings than the vaccination

of non-pregnant heifers, and the author states that this supports the general belief that heifers are more susceptible than cows. The German view is opposed to this, it being held that age has no influence on the rate of infection.

It is stated that the results were very variable as between different herds, although the total figures show in a marked way the value of the method. In some herds vaccination produced no change in the abortion rate, while in a very few cases the treatment appeared to be detrimental. Actual figures of these cases are not given.

The sequelae of abortion were influenced favourably.

The author compares the total percentage figures published in England and Germany with his own, and suggests that the higher percentage of failures shown by his figures is probably to be accounted for by a higher degree of virulence of the infection, and possibly also a greater susceptibility on the part of the cattle.

BRANFORD (R.) & DOYLE (T. M.). **Notes on Contagious Abortion in Pony and Donkey Mares.**—*Agricultural Research Institute, Pusa, India. Bulletin No. 121.* 1921.

Equine contagious abortion made its first appearance at the Government Cattle Farm at Hissar in 1911, and was in all probability introduced by one or more pony mares purchased in that year. The authors note that it is difficult to buy pony mares suitable for breeding Army mules from the original breeders, because of their suitability for pony breeding. The majority of the mares which are sold at fairs or by dealers come into the market either because they are shy breeders, or because they have already aborted.

Pony mares usually abort at an earlier period of gestation than donkey mares.

Symptoms.—Unless mares are far gone in pregnancy, symptoms are, as a rule, quite absent both in ponies and donkeys, nor is there visible discharge. When abortion takes place in the later stages of pregnancy some premonitory symptoms may be observed, and there may be a thin slimy greyish-white discharge. On a number of occasions an aborted foetus has been found in a yard containing twenty or more pregnant mares, and it has been impossible sometimes to discover which mare has slipped her foal. Dilatation of the os uteri after abortion of a three months foetus is not more than is normal in many brood mares.

The chocolate-coloured discharge referred to by American authors has not been observed.

Although in cases of premature birth occurring during the later stages of pregnancy the membranes may appear to be perfectly normal and the foal may be born alive, in no instance has such a foal been reared. Symptoms of joint ill supervene within a few days. The lesions in such foals indicate a generalized invasion of the body by a pus-producing organism.

The etiology of the disease has not yet been definitely established, nor has it been proved that the causal organism is the same in ponies and donkeys, but from foetuses or membranes of both species there has been isolated a short thick Gram-negative bacillus, which gives a thin white growth, showing a tendency to wrinkling on agar.

The facts observed during the outbreak in 1920 would appear to indicate that the period of incubation in donkeys is three weeks or more.

Ingestion is in all probability the method of infection.

The routine procedure of dealing with the disease is as follows :—

1. Aborting mares are isolated for six weeks. The vagina and uterus are washed out daily with a disinfectant for ten days, and then three times a week for the remainder of the period.
2. The foetus, membranes, etc., are burnt on the spot where they are found.
3. The in-contact mares are moved at once to fresh quarters and fresh grazing grounds.

The main difficulty arises from the fact that a mare may abort when grazing, and the act may never be detected, as the foetus and its membranes are devoured by vultures within a few moments.

The disease confers no valuable degree of immunity. Abortion not infrequently occurs twice, and intervals of one, two, or three years, during which the mares foal normally, may occur between successive abortions.

In the majority of cases in ponies (about 70 per cent.) abortion occurs between the third and sixth months. When abortion occurs twice the second takes place at an earlier period of gestation than the first in most instances.

In donkeys the average period of gestation at which abortion occurs is later than in mares. About 40 per cent. abort after the eighth month.

In pony mares more than 75 per cent. of those affected with abortion bred normal foals at some period during the years following the act, and rather more than 20 per cent. proved to be sterile. They were only considered sterile when repeated efforts to get them in foal, both by natural and artificial means, had failed.

As most of the cases of abortion among donkey mares occurred during 1920, it is too soon as yet to arrive at any conclusion as to the frequency with which it may cause sterility in them.

DISEASES DUE TO FILTERABLE VIRUSES.

VAN SACEGHEM (R.). **L'anaphylaxie dans l'hyperimmunisation des Bovidés contre la peste bovine.** [Anaphylaxis in the Hyperimmunization of Cattle against Rinderpest.]—*C.R. Soc. Biol.* 1921. Dec. 10. Vol. 85. No. 36. pp. 1105–1106.

Direct intravenous transfusion of blood can be used with safety for hyperimmunizing immune cattle against rinderpest, provided that the animals have been immunized several (six) months previously. Serious accidents are liable to occur if the immunization has been effected less than six months before.

Direct subcutaneous transfusion is not followed by untoward consequences. The symptoms of anaphylaxis can be immediately arrested by intravenous injections of 5–10 cc. of sulphuric ether.

VAN SACEGHEM (R.). **La vaccination contre la peste bovine.** [Vaccination against Rinderpest.]—*C.R. Soc. Biol.* 1921. Nov. 8. Vol. 85. No. 32. pp. 878–879.

The bulk of this short paper is devoted to an account of the objections that may be raised to the "simultaneous" method of inoculating against rinderpest.

[The author's experience would not appear to agree with that of others who have employed the method on a large scale.—A. L. S.]

The author has devised a method which has proved successful in his hands, and which he terms the "deferred method," as opposed to the "simultaneous method."

It is as follows :—Very small doses of virus (0·1 cc. for Ruanda cattle) are given, and on the second day of the febrile reaction 50 cc. of serum are injected into the jugular vein.

The two great objections to the old method are avoided. There is no longer any danger of neutralizing the virus before it can cause any infection, as the disease is allowed to get a start. The serum is injected when the animal begins to react, and thus renders good service at the right time, and cannot exert any paralysing action on the defences.

ROBERTS (G. A.). **Rinderpest (Peste Bovina) in Brazil.**—*Jl. Amer. Vet. Med. Assoc.* 1921. Nov. Vol. 60. No. 2. pp. 177–185.

This paper contains an account of what appears to be the first official record of the occurrence of rinderpest in Brazil.

The source of the infection has not been traced definitely, but it has been suggested by some that the Indian zebus, which brought the disease into Holland, were also responsible for its introduction into South America.

The first deaths occurred among the draught oxen belonging to a trading company. Shortly afterwards animals belonging to farmers in the locality began to die, these animals having been used for draught work to and from the factory.

Anthrax, black-leg, and haemorrhagic septicaemia were all excluded as the cause of the deaths either at once or after investigation.

Further investigations, involving the inoculation of cattle and goats and small animals, ruled out the bacterial diseases definitely, and established rinderpest as the cause of the deaths.

The disease then broke out among dairy herds, and in one instance an entire herd of 28 head was wiped out in 23 days. The disease did not spread to sheep, but these and goats died from it when they were put with infected cattle.

The period of incubation in natural cases were three to five days, and after inoculation two to four days. A rise of temperature up to 106° or more spread over a period of two to four days, followed by a drop to subnormal in three days or less, was the typical temperature reaction.

Lachrymation and nasal discharge were observed in about 50 per cent. of cases. Respirations were accelerated, and frequently expiration was accompanied by groaning or grunting. The mouth lesions ranged from small scattered patches—with adherent lymph of a yellowish-grey colour, which on detachment left a small erosion—to generalized stomatitis. Diarrhoea on the second or third day after the rise of temperature was a very constant symptom. The colour was greenish-yellow, usually streaked with blood, and the odour was very offensive. The lesions found at the post-mortem were typical of rinderpest.

The disease was known to exist in an area with a radius of 50 miles round São Paulo. A quarantine zone, five miles wide, was established round this area, and movements of animals were prohibited. Within the radius where cattle grazed on unfenced land compensation was paid at the rate of 50 dollars a head for cattle slaughtered and 25 dollars for cattle dying.

When the disease was detected in any premises the owner was advised to slaughter. If he refused he was rigidly quarantined.

The total number of cattle within the area was about 30,000, and of these 600 died of rinderpest and 1,000 were slaughtered.

The last official report of a case of the disease was made on May 23, 1921, and restrictions were removed in August.

It is noted that the indemnity represented about a quarter of the value of the animals.

CURASSON (M. G.) **Notes sur la Peste Bovine en Afrique-Occidentale française et en Pologne.** [Notes on Cattle Plague in French West Africa and in Poland.]—*Rev. Gen. Méd. Vét.* 1921. Oct. 15. Vol. 30. No. 358. pp. 569–59.

This paper represents the results of observations made by the author during a period of four years in French West Africa and during a period recently spent in Poland.

In the author's opinion very considerable variations occur in animals inoculated with virulent blood according to the phase of the disease at which the blood is taken. The classical sequence of symptoms is obtained when the blood is withdrawn from an infected animal at the initial rise of temperature and before lesions develop.

Attention is drawn to what may be termed abnormal reactions occurring in animals inoculated with virulent blood, due to varying degrees of resistance.

No success has been obtained in attempts to demonstrate the presence of antibodies in the rinderpest blood—complement fixation, agglutination, and precipitin tests have all yielded negative results. It appears to be very uncertain whether the leucocyte formula undergoes any alteration during the course of the disease or not, save that in some instances there is a slight increase in the total number during the first few days, and then a slow decrease, which persists while the blood remains virulent.

In four cases the progeny of hyperimmunized animals proved refractory to the inoculation of 5 cc. of virulent blood when injected at ages ranging from 1 to 11 days. These calves were with foster-mothers which had only a serum immunity.

A small number of experiments have been carried out by the author with a view to ascertaining the minimum infecting dose of virulent blood. Doses less than 10 cmm. were of uncertain infectivity, but were always successful in one or more instances.

In two experiments recorded by the author bile was found to be devoid of immunizing power, or at least of the power of conferring any useful degree of immunity. No details are given regarding the bile used. These experiments were carried out in Poland, and the author states that the Polish veterinary surgeons who had had experience of the bile method had formed very unfavourable opinions of it.

The subcutaneous inoculation of animals at the second day of the thermal reaction with 20 cc. to 50 cc. of their own blood prolonged the febrile reaction to a total of five or six days. This point is said to be of value in large serum-making stations, where one is quite likely, in spite of careful arrangement, to have too many virus producers "ready" on any particular day, as it permits of their being kept over for a day or two.

Some points are given in regard to the discussed question of the seat of the virus in the blood.

According to the author, simple laking of the blood with more than five volumes of distilled water is sufficient to destroy the virus. He holds that this is due to the destruction of the red corpuscles, because similar dilution of blood with physiological salt solution is not followed by any destruction of virus. In his view, lower dilutions fail to destroy the virus because some of the red cells escape lysis.

Aqueous humour, urine, and gland juice may all be diluted with distilled water (dilution specifically mentioned, 1 in 20) without destruction of the virus contained in them. The author therefore thinks that in these substances the virus is not attached to any formed elements.

Urine was found to become virulent on the day after the first rise of temperature, and was still infective on the ninth day. It is not stated whether it became avirulent after that.

The blood of two virus producers which recovered was found to be infective on the sixteenth and nineteenth day of the disease. Their urine was not found to be infective. There is nothing to indicate whether the urine was non-infective throughout, or on the days referred to only.

A number of experiments were carried out with a view to testing the sensitizing power of anti-cattle-plague serum. The virus was taken at the initial rise of temperature, and the serum used was the routine product of the laboratory. These were mixed in proportions ranging from equal parts to 1 in 50, and placed in an incubator for periods from 15 minutes to three hours. Quantities representing ½ cc. to 1 cc. of the undiluted virus were then used for the inoculation of animals.

The virus was never destroyed after periods of less than two hours of contact in any dilution. After that the degree of dilution played a part, as virus diluted with ten volumes of serum was destroyed within two and a half hours, while a mixture in the proportion of 1 to 2 proved to have retained its virulence after the same length of time. The author was unable to find any evidence in support of NICOLLE & ADIL BEY'S statement that anti-cattle-plague serum contains a haemolysin.

The milk of hyperimmunized serum-producing cows was found to possess protective powers, but the dose required was about ten times that required of serum to produce the same degree of immunity. Whey was less active than whole milk. Milk retained its protective properties for a period of three weeks (not tested further).

The author suggests the possibility of utilizing the milk of recovered animals for protective purposes in the absence of serum.

The author leaves the question as to the possibility of recovered animals acting as carriers unsettled, but refers to a case in which vaginal discharge from a cow which had " recovered " at least a month previously was in all probability the starting-point of an outbreak in the herd into which she was introduced.

ODERMATT. **Beobachtungen über die Blutimpfungen bei der Maul- und Klauenseuche in der Seuchencampagne 1920 im Kanton Luzern.** [Blood Inoculations during the Outbreak of Foot-and-Mouth Disease in the Lucerne Canton during 1920.]—*Schweiz. Arch. f. Tierheilk.* 1921. Sept. Vol. 63. No. 9. pp. 347–365.

Having summarized the severe outbreaks of foot-and-mouth disease which occurred in Switzerland during the period 1918 to 1920, the author gives a survey of the literature dealing with attempts that have been made to deal with the disease by inoculation with various materials derived from infected or from recovered animals.

He proceeds to detail the arrangements made in Lucerne for the provision of fresh blood from recovered animals for inoculation of infected herds in the field. The animals supplying the blood were bled to death, and the carcases were inspected for evidence of contagious disease. The blood from diseased animals was destroyed.

When an outbreak occurred the freshly obtained defibrinated blood (with carbolic added) was despatched to the veterinary surgeon in charge. An examination of all the animals was first made, and those showing evidence of infection were not injected. Any healthy-looking animal having a febrile temperature was considered as infected and also excluded. The blood was first warmed, and then injected either on both sides of the neck or behind both shoulders, the dose being 150 cc. on each side.

Defibrinated blood was used in preference to serum, because of the greater ease of preparation, the large quantity obtained, and the greater speed with which the fresh material could be placed in the hands of those applying for it.

In some cases sodium citrate or oxalate was used to prevent clotting. Three grams per litre were found to be sufficient, and the salt in this amount produced no harmful effects. The author goes into the question of the factors involved in the varying rapidity with which blood corpuscles sink in the plasma or serum of different animals, and concludes that the rapidity depends upon agglutination of the cells.

Statistics collected showed that the mortality among inoculated animals was 2·2 per cent. (taken on a total of over 8,000), while among uninoculated animals the mortality was 23·05 per cent.

The author also gives figures showing the effect of the inoculations upon the milk production. In nearly 90 per cent. of herds the milk production was favourably influenced by the inoculations.

Accidents as a result of inoculation were rare, and during 1920 only six animals had to be killed as a result of abscess formation, and the percentage on the whole of the animals inoculated after the establishment of the central installation for the provision of blood was 3·47.

Sequelae, such as abortion, disease of the claws, agalaxia, wasting, etc., were not entirely prevented by the inoculation, but they were very markedly reduced. In addition to the fresh blood prepared at Lucerne the so-called Ma-Kla-Serum of the Berne Institute was employed in certain cases. The mortality among the 425 animals inoculated with this was 2·11 per cent., while uninoculated animals on the same premises died in the proportion of 6·9 per cent.

Inoculations carried out on the same premises with the two products for comparative purposes always yielded results in favour of the blood, but this was possibly due to the fact that the dose of the Berne serum was only 200 cc.

The cost of inoculating a large animal was 20 francs.

TARANTINO (B.). **La peste equina in Eritrea.** [Horse Sickness in Eritrea.]—*La Clin. Veterinaria.* 1921. Aug. 31. Vol. 44. No. 16. pp. 441–446.

In this short paper the author describes briefly the clinical characters and lesions of the disease, and refers to the efforts that have been made to prepare protective agents. The bulk of the paper is taken up by a detailed statement of the occurrence of the disease in the different districts.

MISCELLANEOUS.

POLIDORI (V.). **Préparation simple d'une éosinate de bleu de méthylène pour colorations hématologiques.** [A Simple Method of preparing Eosinate of Methylene Blue for Staining Blood Films.]—*Bull. Soc. Méd.-Chirurg. de l'Indochine.* 1921. July. Vol. 12. No. 1. pp. 87–89.

1. A concentrated solution of Borrel's blue.
2. A 1 per cent. solution of Höchst medicinal methylene blue in 90 cc. of 90 per cent. alcohol and 10 cc. of methyl alcohol.
3. A 1 per cent. solution of eosin in alcohol.

For fixation a mixture of equal parts of the three solutions is allowed to act for three minutes.

The staining is then effected by a simple dilution of the Borrel blue solution, 1·5 per cent., and it would appear from the description given that the slide, with its 15 drops of fixative still on it, is placed face upwards in a small dish containing 10 cc. of the dilute Borrel blue solution the dish being shaken for about half a minute to ensure complete mixing of the fixative and stain. The slide is then turned face downwards and left for 10–15 minutes. Wash in water. A pink sediment which may form on the slide is removed by a few drops of 90 per cent. alcohol acting for a very short time.

CLAREMONT (C. L.). **The Ministry's Research (Rat) Laboratory.**—*Jl. Ministry of Agric.* 1921. Nov. Vol. 28. No. 8. pp. 712–718.

Hunting and trapping are not satisfactory means of reducing the number of rats in any infested places, and do not now play any considerable part in the measures adopted for their destruction.

The "virus" method is open to certain objections, of which the chief are: (1) varying susceptibility of the rats to the virus; (2) immunization by sublethal doses; (3) the risk of the virus used being or becoming pathogenic for other animals or even for human beings; (4) doubt as to the disease being to any large extent transmitted from rat to rat, the disease not being contagious, but transmitted only by ingestion of the virus. The possibility is hinted at that these objections may be overcome and that bacteriological methods of destruction may come into use. Poisoning by various means remains the most valuable method of eliminating rats, but it must be borne in mind that the available food supply and shelter are important factors, and that "proofing" must be carried out to the utmost possible limits if poisoning is to be successful.

The work of the Rat Research Laboratory is carried out in one of the old blocks of the Mount Pleasant Post Office, and a small factory is run in conjunction with it.

The Red Squill (*Scilla maritima*) has been the subject of extensive investigation. This bulb has been known to be poisonous for rats for a very long time, but little has been done regarding its chemistry. If the raw bulb be chopped up it soon loses its toxicity. Cooking the bait increases its keeping properties. Powdered dried bulbs are toxic, but the conditions necessary for maintaining the maximum strength are not known. Of such powder 1 gr. or 2 gr. are the minimum lethal dose for a medium-sized rat. The toxic principle has not been isolated with certainty, and nothing is known regarding its toxicity for domesticated animals. Experiments at the laboratory have

shown that rats eat about one-tenth of their body weight per day, a bait should therefore be from 30 gr. to 60 gr., representing one-tenth of the day's food supply, and each bait should contain a lethal dose. Baits should be prepared so that they are ready for use in biscuit or tablet form, and, what is the most important point of all, they must be attractive to the rat. Oatmeal and fat are suitable vehicles. Biscuits may be made by mixing the poison with flour and working it into a dough, which is then baked. Old cheese, fish meal, sugar, or some such material should be added as a flavouring.

In England it has been found that rats prefer a bait which is flavoured with some substance different in nature from that occurring in the principal forms of food obtained in the particular place. It is instanced that in a grocer's establishment fish might be used with advantage. It is said that in India it has been found that a bait similar to the usual diet is most successful.

The following figures are given for the quantities of the different poisons which should be contained in the baits :—

Arsenic, 5 per cent	about 20 gr.
Barium carbonate, 25 per cent. ..	,, 30 ,,
Squill bulbs, 20 per cent.	,, 50 ,,
Squill powder, 20 per cent. .. .	,, 25 ,,

BISHOPP (F. C.) & LAAKE (E. W.). **Dispersion of Flies by Flight.**—*Jl. Agric. Res.* 1921. Aug. 15. Vol. 21. No. 10. pp. 729–766. With 3 figs and 11 tables.

In this paper the authors describe experiments carried out under rural and urban conditions with a view to discovering the distance travelled by flies of a number of species.

Musca domestica, *Chrysomyia macellaria*, and *Phormia regina* were the principal species used, but other species were used in smaller numbers—numbers too small to permit of the founding of sound conclusions.

Details are given of the manner in which the flies were trapped, marked (usually with powdered chalk), liberated, and recaptured and identified. The maximum distances travelled by the three species given above were 13·14 miles, 15·1 miles, and 10·9 miles respectively. It is estimated that about a quarter of a million flies were utilized in the tests. Flies dispersed in all directions from the points of liberation. The desire for food and the seeking of places suitable for oviposition are among the strongest motives inducing dispersion, but it seemed that the passing over of suitable places indicated real migratory tendencies.

Owing to changing wind conditions no exact relationship could be established between direction of wind and direction of dispersion. It would seem that moderate force of wind does not influence direction of dispersion.

Chrysomyia macellaria travelled eight miles in less than 24 hours, and 10 miles in less than 48. *Phormia regina* travelled 11 miles in less than 48 hours, while *Musca domestica* was recovered over six miles away in under 24 hours.

The authors think that the limits of dispersion were not reached during the tests.

REPORT.

ASSAM. **Report of the Civil Veterinary Department, Assam, for the Year 1920–21.**—1921. Shillong. Assam Secretariat Printing Office. pp. 1–17. Price 8 *as.*, or 1*s.*

This report contains details of the work of various branches of the department under the usual headings, and, as an appendix, a report on the veterinary administration of Manipur State. The Superintendent of the C.V.D., Assam, has been appointed Veterinary Adviser to the Manipur Durbar. A portion of the tenth paragraph of the covering letter of the Director of Land Records and Agriculture is worded as follows:—"The resignation of four assistants during the year is regrettable: unfortunately my experience of the department, extending over nine years, shows that no one, on the average, takes up veterinary work except as a last resort. Consequently the general standard of education of the assistants is usually below the matriculation standard. The result is often miserably bad diagnosis and an entire absence of interest in professional work: in fact posts seem to have been accepted mainly as a means of providing an income in uncomfortable and uncongenial circumstances, which should be avoided whenever possible. The ultimate result is that when work is insisted upon, resignation is the only alternative to dismissal."

BOOK REVIEW.

KNUTH (P.) & DU TOIT (P. J.). **Tropenkrankheiten der Haustiere. Handbuch der Tropenkrankheiten, herausgegeben von Carl Mense. Zweite Auflage, Sechster Band.** [Tropical Diseases of the Domesticated Animals. MENSE's Handbook of Tropical Diseases. 2nd Edition. Vol. VI.]—1921. Leipzig. Johann Ambrosius Barth. pp. 1–889. With 143 text figs. and 4 coloured plates. [Price M. 240—bound, M. 264.]

It is stated in the preface of this volume that the manual of which it forms a part is intended for medical men, and certainly it will be of more value to them than to veterinary surgeons, who will not, in all probability, possess the whole series. In other words, the book as a manual of Tropical Diseases of Domesticated Animals is incomplete. The authors are conscious of this defect, as they draw special attention to at least one respect in which this incompleteness is evident. Certain factors in tropical diseases are common to the human subject and to animals and to avoid repetition these factors are dealt with once only—in the volumes dealing with human diseases. It is admitted by the authors that this is unsatisfactory, and it is the more so in that the veterinary aspect is not apparently taken into consideration. It is more particularly in connection with the trypanosomiases that the lacunae in the information given are obvious. A general survey of transmission and the transmitting agents is lacking. Such a defect as this renders the volume unsatisfactory from the veterinary point of view and greatly reduces its value as a separate entity.

The authors have evidently encountered the difficulty of deciding what is to be considered as a "tropical disease," and what diseases occurring in the tropics are to be dealt with. The line of demarcation between diseases occurring in the tropics and in temperate climates is rapidly becoming blurred, and the list of diseases of animals which are not found elsewhere than in the tropics is becoming shorter. The authors

have, therefore, confined themselves to the description of diseases which they consider to be characteristic of the tropics, and have omitted those which, while playing an important part there, have a distribution extending beyond tropical and sub-tropical countries. It is perhaps a difficult question to decide exactly what information a "handbook or manual" should contain. In any case the volume under review is defective by reason of its incompleteness from the point of view of both student and worker whether in temperate climates or in the tropics. This criticism is anticipated by the authors in their preface and they point out that to deal adequately with the diseases occurring in the tropics would require not one, but several volumes. This is self-evident and it indicates the inadvisability of trying to deal in a single volume with so vast a subject. There are five in this manual dealing with the diseases of man in tropical countries.

Probably the most valuable parts of the book are the full lists of references, which are said to be as complete as possible up to the end of 1918. No doubt owing to the necessity of extreme compression the text in many places gives one the impression of being merely a succession of abstracted abstracts strung together, and thus lucidity is to a large extent sacrificed.

The book is divided into six sections dealing with (1) Diseases caused by protozoa; (2) Diseases caused by ultravisible viruses; (3) Diseases caused by bacteria; (4) Diseases due to saccharomycetes; (5) Worm and insect diseases; (6) Diseases due to poisonous plants; and (7) Diseases of which the etiology is not known.

Reference has already been made to what must be considered an important defect in the description of the trypanosome diseases. The general question of identification of species and classification is considered at some length. Each method which has been suggested for this purpose is briefly considered and finally a classification is drawn up, based largely upon the development of the trypanosomes in the transmitting flies, but including groups which are differentiated upon other grounds such as morphology, mechanical transmission, absence of intermediate host, etc. Some of the groups are admittedly very closely allied to each other and it is realised that many objections may be raised to the classification.

In their account of the diagnosis of dourine the authors state that the symptoms of the disease are so characteristic that a mistake can scarcely be made if a diagnosis is based upon the clinical characters. It is, however, under the same heading that they consider the various serological methods of diagnosis which have been introduced or suggested. The difficulty of demonstrating the trypanosome is given as the reason for the investigation of serological methods of diagnosis, but it appears that the necessity for finding a laboratory diagnosis arose from the fact that infected animals may survive for many months without showing any evidence of infection or giving any cause for suspicion that they are infected. In breeding districts, therefore, it is of the utmost importance that a method of detecting latent disease should be perfected.

It is to be regretted that the authors have not given in tabular form their views regarding the classification of the protozoa, as they do not follow international rules of nomenclature, and they do not appear to be consistent. On page 288 Babesia is given as a sub-genus (Untergattung) of Piroplasma, and on page 292 it is stated that although the term Babesia has priority in their classification, *Babesia bigemina* belongs to the sub-genus (Untergattung) Piroplasma.

Valuable space is lost in some cases by introducing information out of its proper place, and this criticism refers particularly to the "definitions" with which each description of a disease begins. For example (p. 523), the "definition" of bovine coccidiosis contains information as to its seasonal distribution, the age at which animals are attacked, and its mortality, all of which are again referred to. A further instance of waste of space is to be found on the same page, where reference is made

in four places to the fact that the disease was first described as occurring in Switzerland, and in three of these instances the author of the original description is named. As already noted the authors state that exigencies of space have compelled them to confine themselves to descriptions of diseases which are characteristic of the tropics, yet one finds a description of " blackhead " in turkeys which runs to six pages, and the distribution of the disease is given as North America, France, Germany, South Africa and Australia.

The only reference to haemorrhagic septicaemia in the whole volume is contained in four lines, where it is mentioned in the differential diagnosis of rinderpest.

Possibly the authors' statement that the volume is up to date to the end of 1918 explains the fact that pre-war names are retained throughout the volume for certain areas in East and South West Africa which have since been re-named.

A. Leslie Sheather.